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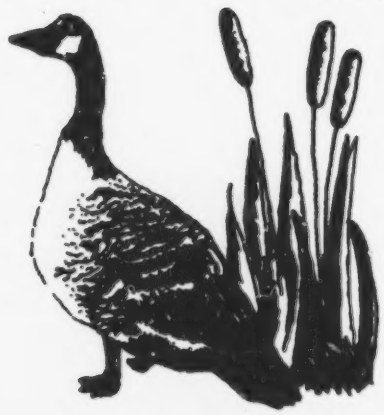

ORIGINAL

PICKWICK RESERVOIR PLAN

Appendix 2 Environmental Quality Controls

CONTENTS

Section A - Soil Erosion Standards
Section B - Visual Management System
Section C - Best Management Practices for Forestry
Section D - Best Management Practices for Agriculture

INTRODUCTION

Implementation of Environmental Quality Controls on Pickwick Reservoir involves the process of environmental assessment in accordance with the National Environmental Policy Act. In addition, most resources are protected by Federal legislation and Executive orders. These directives detail procedures to be followed and in many cases, set limits for impacts to resources in order to protect environmental quality. On TVA land around Pickwick Reservoir, development and management activities must be conducted within these procedures and performance standards. However, in the Pickwick planning process, the need to control soil erosion and visual impacts was identified as a major concern of the public. There is no legislation which addresses these issues, so Management/Development Guidelines specific to Pickwick to limit erosion, and visual impact were developed. These are described in this appendix. Also included are Agricultural and Forestry Best Management Practices. These are practical techniques to minimize pollution or impacts to other resources which will be adhered to on TVA land allocated for these purposes.

Section A
Soil Erosion Standards

SOIL EROSION STANDARDS
FOR PICKWICK RESERVOIR

TVA is requiring that all activities on its lands meet certain soil erosion standards. The goal of these standards is to preserve the natural capability of the land and to maintain high water quality. An area meets the minimum performance standards when it loses no more than 5 tons of soil per acre per year to soil erosion. This 5 tons/acre/year figure is referred to as tolerance. Tolerance is the point where soil loss and soil formation rates are approximately equal.

The following information about soil erosion was derived from the Soil Erosion Potential map for Pickwick Reservoir. The Soil Erosion Potential map was interpreted from a landtype map for the area. This erosion potential map was created by grouping the 15 Pickwick area landtypes into three erosion potential categories, as follows:

Rating	Landtype
Slight	1, 7, 8
Moderate	2, 9
Severe	3, 4, 5, 6, 10, 11, 12, 13, 14, 15

The main factors that determined the erosion rating for each landtype were slope and innate erodibility.

The following chart will explain why the landtypes were included in each erosion category, what erosion problems will be caused by each of the three major landuse activities (agriculture, forestry, and construction), and what types of erosion control activities will be needed to bring levels of soil loss within tolerance. The erosion control activities that are listed have been included only to provide an idea of what types of erosion control activities might be necessary to stay within tolerance. It is the responsibility of the person(s) initiating an activity to work with the local SCS district conservationist to develop and implement a soil erosion control plan, tailored to a given site, that will keep soil loss within tolerance.

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Slight

Agriculture

These landtypes are the low-lying, nearly level bottomlands of streams and rivers. The soils are the most productive in the area and are likely to be row-cropped if the field size is adequate and the area is accessible. Because of the gentle slopes and low-lying position, soil erosion is a hazard only when row-cropping is continuous and the crop residue is removed or plowed under before winter. To keep soil erosion levels below tolerance, the areas near the streams must be protected and the remaining areas must be covered by either row crops, crop residue, or cover crops throughout the year. The local SCS Soil Conservationist can provide a conservation cropping plan that is tailored to each site, and that will keep soil erosion below tolerance.

Slight

Forestry

Because of the high productivity of these landtypes, most of these areas have been converted to agriculture. The forested areas that remain exist primarily because they are relatively wet or inaccessible. The main methods of keeping soil loss below tolerance consist of protecting streams along their banks and at stream crossings, and preventing and controlling runoff along logging roads. For more information consult Best Management Practices for Forestry, and the local Soil Conservationist.

Slight

Construction

These landtypes have not undergone major amounts of construction because they are either inaccessible or are being used for agriculture. In many ways these areas are prime candidates for development because of their levelness and depth of soils, but are unsuitable because of frequent flooding. The primary methods of keeping soil erosion below tolerance are minimum alteration of the shape of the land, topsoil storage, sediment collection, and seeding of cleared areas. The local Soil Conservationist will provide specific methods for controlling erosion.

Moderate

Agriculture

These landtypes consist of high productivity uplands and terraces. These areas are still level to gently sloping, but soil erosion is more of a concern because of their upland position. Runoff from these areas can worsen erosion on surrounding landtypes that have lower topographic positions. These soils also are more innately erodible than those grouped in the slight category. Most of these areas are used for row crops unless they are wet or too small to be a workable field. Soil conservation practices on these areas differ from those of the slight category in that crop rotations include longer periods of sod crops or minimum tillage is used with shorter rotations. Protection of streams is still a major concern. The conservation tillage plan provided by the local soil conservationist will contain details about how these soil conservation techniques can be applied to each site.

Moderate

Forestry

Almost all of these landtypes have been cleared, and are now being used for row crops. The few remaining forested areas are found mainly on river and stream terraces. The main method of controlling soil erosion on these areas consists of controlling runoff on logging roads and protecting the streams that cross these areas. The "Best Management Practices for Forestry," and the local district conservationist can provide specific methods for keeping soil erosion below tolerance.

Moderate

Construction

While most of these areas are in row crops, some of these areas are being developed because of their proximity to major population centers. The main methods for minimizing soil erosion in these areas are protection of streams, topsoil storage, minimum alteration of the topography, sediment collection, and seeding bare areas. The increased erodibility of these areas make it very important to follow the soil conservation plan designed by the local soil conservationist.

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Severe

Agriculture

These landtypes are highly erodible because of their steep slopes and the extreme erodibility of the loess that caps many of these areas. In most cases the land is simply not suitable for agriculture. In some cases agriculture would be possible if intensive conservation practices such as terracing and minimum tillage are applied. The local soil conservationist can determine on a site-by-site basis if an area is suitable for agriculture, and if so, what conservation practices will need to be applied.

Severe

Forestry

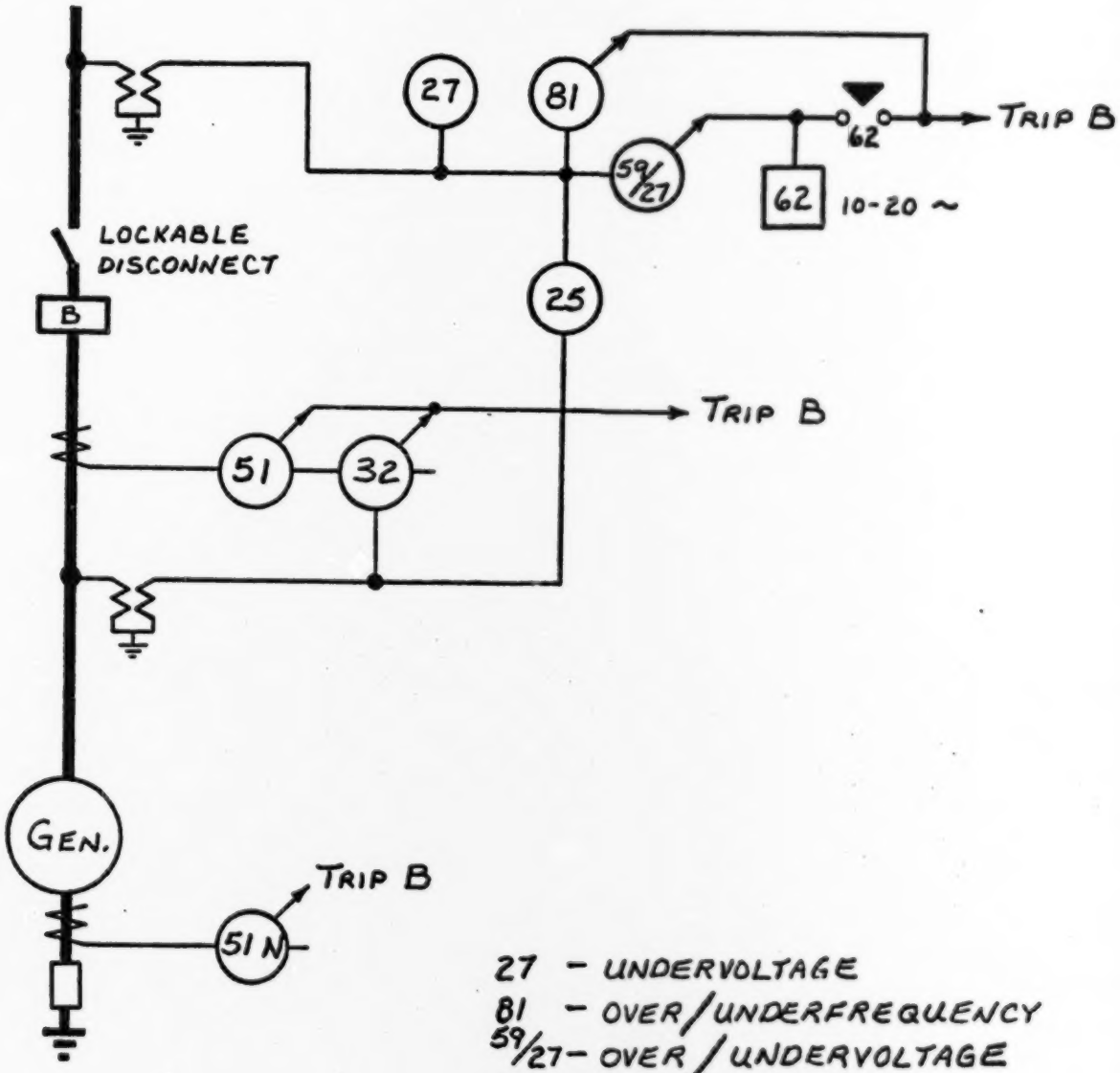
These severely erodible landtypes are the areas that are most likely to be forested. The western portion of the Pickwick area is in the Coastal Plain physiographic region which largely contains slow-growing hardwoods. The steep slopes of these landtypes make it imperative that runoff on roads and landings be controlled. Intermittent and permanent streams will need extra protection because the high amounts of sediment-carrying runoff that will be produced in these areas. "Best Management Practices for Forestry" explains some of the erosion control techniques that will be necessary on these sites. The local soil conservationist can provide a plan to control erosion for each site.

Severe

Construction

Most of these landtypes are unsuitable for large-scale development. Homes and other small buildings can be located on these sites if proper erosion control techniques are used. In many cases the topography of the sites must be altered to compensate for the steep slopes. Seeding of cleared areas, topsoil storage, and sediment collection will be important soil erosion control techniques. The local district conservationist will be able to provide a plan for keeping soil loss to a minimum.

Section B
Visual Management System



27 - UNDERVOLTAGE
81 - OVER/UNDERFREQUENCY
59/27 - OVER/UNDERVOLTAGE
25 - SYNCHRONIZING
32 - REVERSE POWER
51 - OVERCURRENT
51 N - GROUND OVERCURRENT
62 - TIMER

FIG. 8 TYPICAL RELAY REQUIREMENTS FOR GENERATOR INTERCONNECTION

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VISUAL MANAGEMENT SYSTEM
A SUMMARY DESCRIPTION

Consistent with an expressed goal of the Pickwick Reservoir Plan to protect the environmental quality and aesthetic amenities of the Pickwick area, the goals of the Visual Management System are:

To enable objective evaluation of the visual consequences resulting from a proposed development action; and

To base the evaluation on a clearly defined set of criteria and assumptions regarding community values and methodological procedures.

Input from the Visual Management System enables the evaluation of the relative change in the visual environment resulting from a specific development action.

Any system proposing to manage the visual environment is ultimately based upon a set of values concerning beauty and the landscape. In this case, the visual values of most importance are those held by the communities surrounding Pickwick Reservoir.

Critical assumptions regarding community values and methodological procedures are set forth as follows:

Community Values

Based upon the results of public meetings; it is assumed that wooded shoreline is the generally preferred landscape.

However, actions resulting in increased visual diversity are assumed to be beneficial provided (a) perception of the dominant landscape remains intact, and (b) the type of development creating the diversity is visually acceptable.

Although the visual management system is applied to the entire Pickwick Reservoir, it is assumed that areas visible from the water area are of greater concern than those areas not within the water surface viewshed.

Methodological Procedures

The visual management system is based primarily on the evaluation of the landscape without regard for its surroundings. The analysis does not attempt to address the many variables affecting a person's perception of a landscape such as location, weather, or the views of surrounding landscapes.

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It is assumed that as the relative number of views increases, the relative importance of the viewed landscape also increases. Therefore, detrimental change in the visual environment is least offensive when limited to areas of low visibility.

To identify areas of visual importance or preference, two maps were prepared. The first depicted the inherent visual quality of the study area and the second identified those areas on the reservoir which either received a high intensity of use by visitors and boaters or were of special significance archaeologically, historically or because of local importance. The inherent visual quality map was derived from existing landform and landcover maps for the Pickwick Reservoir area. The combination of these two factors established a map of inherent visual quality of the Pickwick area based on topographic diversity correlated with physical characteristics and aesthetic perception (derived from community value statements at the public participation sessions) of the different land use and landcover patterns in the reservoir area.

The Use Intensity and Significant Areas map was derived from information regarding the amount of use or visitation that various areas of the reservoir receive, and the location of areas of land or water that have some importance attached to them by residents of the area. These may include parks, recreation areas, historic sites, archaeological areas, cemeteries, etc.

Visual Importance Values were derived from the correlation of amount of use or visitation with the special significance of an area.

A final map of Visual Quality Zones was developed as a composite of Visual Importance (use intensity and area significance), and Inherent Visual Quality (topographic diversity and visual characteristics of land use patterns). Areas within the highest visual quality zones are of most concern. Development actions in these areas will be carefully evaluated to determine their impact on the visual environment. Techniques for mitigating adverse impacts can then be developed. These areas have been designated as "Visual Protection" in the Plan.

Section C

Best Management Practices for Forestry

BEST MANAGEMENT PRACTICES FOR FORESTRY

TVA is interested in maintaining high standards of pollution control on its forest properties to maintain environmental quality, set an example for private ownerships, and comply with State and Federal water quality guidelines. All States are required by the Federal Water Pollution Control Act Amendments of 1972 to develop plans for the reduction and control on nonpoint pollution sources. The Clean Water Act of 1977 also addresses additional areas of concern. The intent of this document is to set forth practices that will meet or exceed the requirements of both acts and of the individual Valley States.

Potential Impacts of Forest Operations on Water Quality

The principal water pollutants that may be generated by forestry activities are generally identified as sediment, organic debris, thermal pollution due to decreased shade cover, and chemicals such as herbicides and fertilizers. Of these, sediment is by far the most common pollutant resulting from forest operations.

Sediment

The small percentage of erosion in the Valley arising from forest operations does not imply that the resulting sedimentation is unimportant. It may have a heavy impact on individual sites. Heavy concentrations of suspended sediment can interfere with the aquatic food chain by smothering bottom organisms; interfere with photosynthesis by reducing light penetration; serve as a carrier of nutrients and pesticides; and inhibit fish reproduction and alter streamflow.

Sediment is basically caused by soil disturbance and exposure, which, in forest operations, largely occurs from road and trail construction and use, harvesting operations, and site preparation. Proper placement, construction, and maintenance of forest roads, trails, and other soil disturbances can dramatically reduce sediment delivery to streams.

Organic Matter and Debris

Streams flowing from undisturbed watersheds normally carry levels of organic debris which provide food and habitat for fish-food organisms. However, excessive organic waste like logging debris (logs, stumps, treetops, or sawdust) can adversely impact water quality. It can create stream obstructions which may alter stream channels, resulting in streambank erosion and downstream sediment deposits. Decomposition of such organic matter in the stream though unusual, can reduce levels of oxygen below that necessary for acceptable growth and development of some fish and fish-food organisms.

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Thermal Effects

Water temperatures may rise following harvesting as a result of the removal of shading vegetation along streambanks. Complete removal of shading vegetation can accompany clearcutting or intensive mechanical site preparation. The amount of temperature increase is related to the surface area of water exposed to direct sunlight. Stream temperature increases as much as 21 degrees F. have been observed, although increases of 4-10 degrees are more the rule. Thermal pollution is of concern primarily in waters that are the habitat of oxygen- and temperature-sensitive aquatic life.

Forest Chemicals

Chemicals, fertilizers, pesticides, herbicides, and fire retardants have limited use in most forest operations. Any one of these chemicals, however, if allowed to enter water bodies in heavy concentrations, could have an adverse impact on aquatic life or render the water unfit for human consumption.

Approved pesticide applications for the control of insects or undesirable trees and brush are an acceptable forest management practice. Experience has shown that where untreated buffer strips are maintained and where drift or direct application to water surfaces are prevented, water quality in streams is not adversely affected.

Use of fire retardants and fertilizers will probably be a rare occurrence on TVA lands.

Pollution Reduction Guidelines

There are a number of forest management and harvesting activities which can affect water quality. The effects of these activities can be minimized through the use of proven techniques for reducing the various forms of pollution. The techniques presented should be used as guidelines or standards in forestry operations on TVA lands and should be followed wherever possible and practical.

Adherence to these guidelines will require provision of additional information and guidance to those operating on TVA forest lands. In advertised timber sales, it will be necessary to inform bidders of what is expected in terms of the guidelines on a site-specific basis. Since logging cost and enforcement activities will probably increase, bidding should reflect these anticipated expenses.

Access roads are constructed to connect the harvesting or other forest activity with a farm or public system road. Temporary or infrequent periodic use is assumed. Higher construction standards for permanent use roads would be necessary.

A. Location

1. General. Topography, property lines, and economic limits on skidding often dictate the approximate location and extent of the road system. Potential primary and alternate locations should be identified and then discussed and marked or agreed upon with the contractor. Significant location deviations require forester approval.

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2. Slope. It is desirable to keep sustained grades less than 12 percent but short pitches of steeper grades will be occasionally necessary.

3. Obstacles. Rock outcrops, ledges, swampy or wet places, and other features apt to present difficulties in construction and maintenance should be avoided if possible.

4. Distance from Streams. Roads should be located far enough from streams to provide sufficient filtering area for the road surface drainage (see Filter Strip specifications). Locations near and along intermittent watercourses should be as infrequent as possible.

5. Stream Crossings. Streams are defined as perennial watercourses. Stream crossings with roads and skid trails should be avoided if possible, but when necessary they should be made at right angles to the stream. A temporary bridge or culvert is preferable, but fords are acceptable on gravel or rock. Roads should slope upward on both sides of crossings to prevent water from running down the road during high streamflows.

6. Intermittent Stream Crossings. Cross at right angles if possible and consider using a crossing structure (not necessarily a culvert or bridge) in some situations (wet season logging and marginal crossings).

B. Construction

1. Adequate drainage is the single most important factor in controlling erosion and keeping a road in serviceable condition. Adequate drainage during use is desirable.

2. During construction, break sustained grades with short segments of reverse grade or with judicious use of broad-based dips.

3. Where consistent with safety, road surfaces can be outsloped and other drainage control measures reduced.

4. Cuts and fills should have side slopes that are stable.

C. Maintenance

1. Road surface grading or other measures should be conducted when necessary to keep drainage structures functioning.

2. Hauling should be stopped when road conditions are so wet that rutting destroys the effectiveness of drainage structures.

Landings

A. Locate landings to keep skidding and hauling on as gentle a grade as possible consistent with other factors. Landing locations should be discussed and agreed upon with operators.

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B. Adequate filter strips should be left between landings and streams (see Filter Strips) and, if possible, avoid placement near intermittent streams.

Skid Roads and Trails

A. Uphill skidding is preferred to downhill skidding.

B. Skidding should be stopped in wet weather when deep rutting occurs outside of main skid trails.

C. Stream crossings should be avoided if possible (see Filter Strips). Culverts logfills or box drains should be installed at stream crossings unless there is a rocky bottom.

D. Crossings and skidding in the natural drainway of intermittent streams should be minimized.

E. On heavily used skid roads on steep slopes, water bars should be installed immediately after use.

Retirement

A. Consistent with post logging usage, roads should be retired after logging. Surfaces on landings and roads should be smoothed. Road berms should be removed where possible and water bars or broad-based dips made functional or installed at about the following spacings: Spacing (ft.)$= \frac{400}{\text{Grade (\%)}} + 100$

B. Bridges, culverts, and other crossing structures should be removed and streambeds cleaned of soil and debris and restored to natural slope and grade.

C. Disturbed areas near stream crossings and large landings should be revegetated. Those heavily used skid trails on steep slopes, road surfaces, banks, landings, or other areas subject to continued excessive erosion should be revegetated (see Vegetative Establishment on Disturbed Areas).

D. Water turnouts or bars should be installed on skid trails with exposed mineral soil after completion of the job at maximum spacings as listed above.

E. Treetops and logging debris should be removed from streams.

Felling

Avoid felling trees into streams.

Soils

Confer with local SCS personnel or soil maps to determine soil sensitivity to erosion. Where sensitivity is high, adhere to lower range of guidelines or adopt more restrictive measures.

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Filter Strips

A filter strip is an area of woodland located in or adjacent to a stream or lake where only limited disturbance is desirable to maintain water quality by filtering sediment from surface water runoff and maintaining water temperature.

A. Width

Slope Adjacent to Stream (%)	Filter Strip Width (ft)
0	25
10	45
20	65
30	85
40	105
50	125
60	145
70	165

B. Activities within Filter Strip

1. Acceptable - Felling of timber, winch skidding, timber stand improvement, any harvesting that does not remove more than 50% of the crown canopy from the stream channel edge.

2. Undesirable - All wheel and crawler vehicles, roads and skid trails except at designated crossings, log landings, mechanical site preparation, prescribed burning, spraying of pesticides.

Site Preparation

Removal of part or all of the existing vegetation by mechanical disturbance of soil surface to aid in natural regeneration or artificial establishment of a new stand.

A. Intensity should be the minimum required to achieve the needed results.

B. Scarifying and windrowing should be done along natural land contours.

C. Follow Filter Strip specifications; expand filter strips to include intermittent streams.

D. Follow Prescribed Burning specifications if burning is conducted.

E. Slope limitations - 30-35%.

Prescribed Burning

A. Construct fire lanes on contour and on as gentle slopes as possible consistent with area to be burned.

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B. Install H_2O bars or turnouts in plowed fire lanes at spacings in "Road Construction."

C. Maintain Filter Strip specifications.

Vegetative Establishment on Disturbed Areas

The primary objective is to establish a protective vegetative cover as quickly and economically as feasible and should protect the site with a minimum of maintenance until native vegetation takes over. Wildlife benefits should be sought consistent with the primary objectives.

A. Location - Stream crossings, disturbed areas in or near intermittent streams, large landings, and areas subject to continued excessive erosion should be revegetated.

B. Specifications for Fertilizer and Seed

The following reflects practices that have been recommended and includes discing and application of 2 tons lime/acre. These practices should be adapted to local conditions.

Seed Mixture 1/3/	Seed Rates Lb/Acre	Fertilizer Lb/Acre 2/	Recommended Seeding Time
Ky. 31 Tall Fescue or	20-25	500 - 6-12-12 or	Spring
Orchard Grass and	15-20	300 - 10-20-20 or	Fall
White Clover, La. Dutch, Ladino or Korean Lespedza	2-3 4-5	375 - 8-16-16	Spring, Fall

1. Favor fescue and La. Dutch White Clover on the droughty sites. Favor orchard grass and Ladino White Clover on the moist and more productive sites, especially when emphasizing wildlife habitat improvements.

2. Additional nitrogen may be required to promote a more vigorous growth and speed up the establishment of a vegetative cover. Where needed, topdress spring seeded mixtures with 50 to 100 pounds of ammonium nitrate per acre 4 to 6 weeks after emergence. For fall seedings apply 50 to 100 pounds of ammonium nitrate at the beginning of the following growing season, e.g., in late winter or early spring.

3. On harsh or more droughty sites mulching may be needed to conserve or stretch the scant moisture supply. Other alternatives on the drier sites would be to add two pounds of crown vetch seed per acre to the seed mixture. Also, 30 pounds of scarified sericea lespedza per acre may best be seeded from April 15 to June 1 and fertilized with 200 to 300 pounds of 0-20-20.

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Pesticides

A. Consider alternative means of accomplishing objectives.

B. Follow Filter Strip specifications and expand to intermittent streams.

C. Follow label precautions.

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Section D

Best Management Practices for Agriculture

AGRICULTURAL
BEST MANAGEMENT PRACTICES

Practice Number	Practice Name	Practice Description and Highlights
1	Change in Land Use	Changing to a less intensive use. Sometimes the cost of applying practices adequate for erosion control on cropland highly susceptible to erosion cannot be economically justified. A change to grass or trees is the best alternative. Most applicable on subclass IVe and higher cropland.
2	Chiseling and Subsoiling	Deep tillage to shatter compacted soil layers or traffic pans. Permits more effective development of plant roots. Increases water infiltration rates and reduces runoff. Most effective on sandy soils with traffic pans.
3	Conservation Tillage (Minimum Tillage)	Includes a variety of tillage systems, including no-tillage, where soil disturbance and the number of cultural operations are reduced to a minimum. Much residue from the previous crop is left on the soil surface. Excellent for erosion control. Minimizes spring sediment surges produced during periods of high intensity rainfall and runoff. Helps retard weed growth and conserve moisture. Generally, requires more pesticides and better management skills than conventional tillage.
4	Contour Farming	Crops are cultivated across slopes with the contours of the land instead of up and down slopes. Includes farming along established grades of terraces, diversions, or contour strips. Inexpensive to implement. Can reduce soil loss by 50 percent on moderate slopes (2 to 7 percent), less on other slopes.
5	Critical Area Planting	Establishment of permanent vegetation on critically eroding areas. Requires greater amounts of fertilizer and lime, higher seeding rates, and more seedbed preparation than normal vegetation operations. Often used in combination with structural practices such as grade stabilization structures. Excellent for erosion control. Fertility and soil moisture are normally low in critically eroding areas, and intensive maintenance is often required after vegetation is established. Examples of applicable critically eroding areas include drainageways, access roads, denuded areas in the Blackbelt, streambanks, and farm and logging roads.

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AGRICULTURAL
BEST MANAGEMENT PRACTICES

Practice Number	Practice Name	Practice Description and Highlights
6	Crop Residue Management	Retaining crop residue on the soil surface after harvest and allowing to remain until land preparation for the next crop. Residue is incorporated when seedbed for the next crop is prepared. Adds organic matter, improves soil tilth, and provides moderate erosion control. Most used in combination with other erosion control practices. Inexpensive to implement.
7	Crop Rotations	Rotating species of crops planted in succeeding years. Does not include rotation with grass and legumes. Can aid in disease and pest control, thereby reducing the amount of pesticides needed. Provides better utilization of plant nutrients. May provide more continuous soil protection than one-crop systems. Much less effective than Practice Number 21, Sod-based Rotations.
8	Debris Basin (Sediment Basins)	Construction of dams across watercourses to help filter out sediment and related nutrients. Runoff water is slowed but allowed to pass through. This permits much of the sediment and nutrients to settle onto the basin bottom while runoff is temporarily detained. Reduces sediment and nutrient deposition into streams but does not control erosion.
9	Pond	A water impoundment made by constructing a dam or embankment, or by excavating a pit or "dugout". Similar to a Debris Basin, except that an excavated pond will act as a permanent sediment and non-point source pollutant "trap".
10	Diversions	A channel with a supporting ridge on the lower side constructed across the land slope. Allows interception of runoff and disposal at a selected location. Diversions serve to reduce the length of slopes and to channel surface runoff to suitable outlet locations. A primary purpose is protection of land below the structure. Effective in diverting animal waste runoff from streams. Used in combination with sod to filter out nutrients and fecal bacteria. Reduces soil erosion on cropland and critically eroding areas.

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AGRICULTURAL
BEST MANAGEMENT PRACTICES

Practice Number	Practice Name	Practice Description and Highlights
11	Grade Stabilization Structure	Structures designed to stabilize erosion occurring in natural and artificial channels where erosion occurs due to significant elevation differences. They are designed to either reduce any sharp change in elevation, or grade, or to provide a stable area where the change in elevation takes place. Substantially reduces erosion and off-site sediment damage associated with channel and gully erosion.
12	Grassed Filter Strip (Field Border)	A strip of vegetation established on field borders or edges. A relatively inexpensive method of filtering sediment, nutrients, pesticides, and fecal bacteria from runoff. Often used in combination with other practices such as terraces and grassed waterways. Research indicates that filter strips can remove the majority of the nutrients in surface runoff. They also provide turn rows and access roads to crop fields.
13	Field Windbreak	A dense strip of vegetation (generally trees and shrubs) established on the up-wind field edges to aid in preventing soil erosion as a result of exposure to wind action.
14	Grassed Waterway or Outlet	Natural or constructed open drains, shaped and vegetated with close-growing sod. Designed to prevent erosion in drainageways where runoff water concentrates. Most often used in row crop fields. Often used to provide a runoff outlet for terraces or diversions. Highly effective in reducing channel or gully erosion. Serves the same filtering function as described in Practice Number 11, Grassed Filter Strip (Field Border).
15	Streambank Protection	Stabilizing and protecting banks of streams, lakes, estuaries, or excavated channels against scour and erosion by vegetative or structural means.
16	Wetland Protection and Preservation	Wetlands serve as a buffer strip component of a farm water management system. Protection and preservation of wetlands maintains this feature and also promotes wildlife use.

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AGRICULTURAL
BEST MANAGEMENT PRACTICES

Practice Number	Practice Name	Practice Description and Highlights
17	Floodwater Retarding Structure	Floodwater retarding structures are installed to reduce flood damages downstream by controlling the release rate from flood flows of predetermined frequencies. They may also permit the use of more economical channel improvements or stabilizing structures in the channel downstream, and reduce environmental hazards and pollution.
18	Land Smoothing and Leveling	Done to remove surface irregularities. Simplifies the flow of water in a small drainage area, allowing for better control of surface runoff. Most effective when used in combination with other practices, such as terraces.
19	Lined Waterway or Outlet	A runoff channel properly sized and shaped and lined with an erosion resistant material. Most common type is a concrete flume. Expensive to install but is sometimes necessary to stabilize critically eroding areas. Most used in combination with vegetative practices such as critical area planting.
20	Livestock Exclusion	Preventing livestock from entering a particular area. Includes fencing open drainageways or natural streams to prevent streambank grazing or elimination of animal waste directly into the stream. Also includes fencing, or other type removal, of livestock from newly vegetated areas to prevent damage to the sod.
21	Livestock Watering Facilities	Watering facilities provided to supply an alternate source of water from natural drains or streams, and/or to distribute grazing to prevent sod damage and resulting erosion in any one area. Includes ponds, wells, spring developments, and tanks furnished by pipelines. Some sites lend themselves to application of any one of the facilities listed, with a more narrow choice possible at other sites. The most economical source of an adequate water supply at any given site is the "Best Management Practice."

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AGRICULTURAL
BEST MANAGEMENT PRACTICES

Practice Number	Practice Name	Practice Description and Highlights
22	Agricultural Waste Management System	A planned agricultural waste management system to contain and manage liquid and solid wastes including runoff from concentrated waste areas with ultimate disposal in a manner which does not degrade air, soil, or water resources. This practice includes systems for safe disposal of livestock wastes, municipal waste treatment plant effluents and sludges, and agricultural processing wastes through use of soil and plants.
23	Mulching	Application of a biodegradable material such as hay, straw, animal manure, poultry litter, or wood shavings to erosive areas newly planted to grasses or legumes. Helps insure an adequate stand of vegetation by retaining soil moisture, retarding weed growth, controlling soil temperature, and reducing erosion. Especially applicable on critically eroding areas.
24	Pasture and Hayland Planting	Long-term stands of perennial, biennial, or reseeding forage grasses and legumes, established to provide livestock food, protect soil from erosion, and reduce runoff.
25	Pasture and Hayland Management	Good management of grazing and clipping intensity, soil fertility, disease control, and water supply can insure vigor of pasture sod.
26	Row Arrangement	Arranging row patterns to provide drainage toward desired outlet. Effective on flatter slopes for draining runoff water through a grassed filter strip or grassed waterway prior to entering a stream. Can often provide a more efficient pattern for farming operations.
27	Sod-based Rotations	Rotating field crops with sequences of grasses and legumes. Excellent nonstructural method of reducing erosion and related sediment and nutrients. Total soil loss is greatly reduced for the rotation cycle as compared to continuously tilled field crops. However, soil loss is unequally distributed over rotation cycle. Best adapted to farms where a part of the enterprise includes livestock production, seed crops, or commercial production of hay.

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AGRICULTURAL
BEST MANAGEMENT PRACTICES

Practice Number	Practice Name	Practice Description and Highlights
28	Soil Incorporation of Fertilizers	Mechanical incorporation of nutrient sources into a normal zone of soil tillage. Provides more effective plant utilization of nutrients and decreased nutrient losses in runoff. Usually more expensive than broadcast application of nutrient sources. Not always possible.
29	Land Absorption Areas	Irrigation of appropriate land areas suited for crops or forage with recycled wastewater effluents and nutrients.
30	Stripcropping	Alternating arrangement of field crops and close-growing grasses and legumes in strips or bands across slopes, with the contour of the land. Soil loss is reduced by about 50 percent over the same cropping system utilizing contouring alone. The alternating grass strips also act as filter strips, removing sediment, nutrients, and pesticides. Site must be suitable to across-slope farming and establishment of rotation grasses. One disadvantage is that half the field is removed from crop production. Primary use of the grass strips is hay.
31	Subsurface Drain	Pipe or tile, usually plastic, installed underground to lower the ground water table and prevent wet areas on the surface. Can reduce surface runoff. May cause additional nitrate leaching. Limited in applicability.
32	Surface Drainage	A ditch or channel constructed to transport surface flow to a suitable outlet. Not effective in erosion control. May be used in selected areas of low lying, relatively flat fields adjacent to streams to transport surface flow through a filter strip prior to entering the stream. Surface ditches are seldom vegetated. Limited in applicability.

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Practice Number	Practice Name	Practice Description and Highlights
33	Temporary Vegetation	Planting close-growing plants that have quick growth characteristics for short-term, seasonal soil protection. Primarily applicable to areas void of vegetation and subject to excessive erosion, but future land use plans preclude establishing permanent vegetation, or immediate protection is needed until permanent vegetation can be established.
34	Terraces	Earth embankments or ridges with a channel constructed across the land slope at suitable spacing and an acceptable grade to reduce erosion damage by intercepting surface runoff and conducting it to a stable outlet. Functions much the same as Practice Number 9, Diversions, except that terraces are usually constructed closer together, support less total watershed, are smaller than diversions, and are not vegetated. One of the most widely used erosion control practices on cropland. Fields where terraces are applied can usually be maintained in productive condition and maximum yields can be sustained.
35	Tile Outlet Water Disposal System	Terrace systems installed with underground plastic pipe water outlets. The pipe or tile is installed in natural drainageways. As much as 90 percent of the soil that erodes between terraces may be deposited in the terrace channel. High installation cost.
36	Timed Application of Fertilizers	Applying fertilizers at specified rates and at proper times to maximize nutrient utilization by plants and reduce nutrient loss in runoff. Often very difficult to predict, and does not fit the schedule of other crop management functions. Inexpensive to implement where applicable.
37	Tree Planting	Planting adapted species of trees as seedlings. Takes several years to provide the optimum cover for erosion control. Adapted species of grasses or legumes should also be planted for short-term erosion control. Especially applicable to critically eroding areas where low maintenance is desired.
38	Woodland Direct Seeding	Same as above, except involves the aerial application of seeds rather than the planting of seedlings.

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Practice Number	Practice Name	Practice Description and Highlights
39	Woodland Site Preparation	Treating areas to encourage natural seeding of desirable trees or permit reforestation by planting or direct seeding.
40	Use of Alternate Pesticides	Replacing the use of a pesticide with a less toxic substance that will yield similar benefits for pest control. An alternate is not always available. Primarily applicable where extremely toxic pesticides are a repeated problem.
41	Use of Pest Resistant Crop Varieties	Use of selected crop varieties locally adapted and resistant to specific diseases or pests, eliminating the use of some pesticides. Useful only in selected circumstances. Some resistant crops have lower yields than nonresistant varieties.
42	Integrated Pest Management	Use of prescribed combinations of natural biological controls and pesticides.
43	Improved Pesticide Application Techniques	Involves several land user handling and application techniques that reduce pesticide concentrations in streams: timing pesticide applications to maximize pest control and reduce pesticides in runoff, use of proper application rates, managing aerial applications, and proper land user handling and application of pesticides.

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